

BELLCOMM, INC.

955 L'ENFANT PLAZA NORTH, S.W.

WASHINGTON, D.C. 20024

SUBJECT: Trip Report - Seventh Meeting of
the Guidance, Performance and
Dynamics Subpanel, October 23,
1968 - Case 610

DATE: November 7, 1968

FROM: K. E. Martersteck

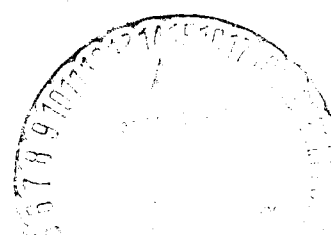
ABSTRACT

The seventh meeting of the AAP Guidance, Performance and Dynamics Subpanel was held at MSFC on October 23, 1968.

MSC indicated that Hohmann cross-product guidance following a S-IVB guidance cutoff is preferred if the 2-1/2 stage-to-orbit CM/SM launches are baselined. Various automatic sequence schemes to ignite the SPS as soon as possible after S-IVB shutdown are being investigated.

The launch impact of the recently baselined 35° orbit inclination was discussed. The CM/SM may not be able to rendezvous until the day following launch if excessive phasing must be done. However, the unmanned LM/ATM must still rendezvous by the fourth orbit. This constraint will severely restrict LM/ATM launch opportunities.

Agreement was reached on the generation of design trajectories for the CM/SM flights.



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MEETING OF THE GUIDANCE, PERFORMANCE AND
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MEMORANDUM FOR FILE

The AAP Guidance, Performance and Dynamics (GP&D) Subpanel seventh meeting was held at MSFC on October 23. This was the first meeting of the subpanel since March 1, 1968. Following the previous GP&D meeting, the Mission Requirements Panel closed out all outstanding GP&D action items so this meeting began with a clean slate.

The first major item of discussion was the 2-1/2 stage-to-orbit maneuver (SPS suborbital ignition) which may be baselined for CM/SM launches. MSC reported the results of a TRW study which recommends the use of Hohmann cross-product guidance for the CM/SM during this SPS burn. This guidance scheme assumes S-IVB cutoff at perigee and controls the SPS burn to enforce a desired apogee. It is recommended that the S-IVB have a guidance cutoff and therefore carry its own flight performance reserve. Also the S-IVB must place the spacecraft into the correct orbital plane because the CMC cross-track errors will preclude sufficiently accurate out-of-plane PGNCs guidance during the SPS burn.

Since the payload gain is very sensitive to the delay between S-IVB shutdown and SPS ignition, MSC is considering automatic sequencing in the CM/SM. The sequence could be initiated either by a discrete sent from the IU via hard wire to the CMC or by the CM IMU sensing S-IVB cutoff. SPS ignition would occur 4-6.5 seconds later.

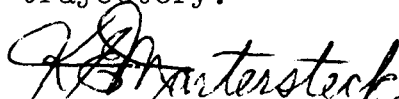
Next the Panel turned its attention to the launch impact of the 35° inclination now baselined for the AAP cluster. MSC presented a chart showing predicted launch windows and phase panes for the AAP missions. It appears that in-plane/in-phase opportunities are relatively few compared with the situation at 29° where at least one such opportunity occurs daily. Therefore, for the 35° inclination missions, CM/SM rendezvous may have to occur as late as 16-20 orbits after launch. Since the CM/SM rendezvous phasing is ground controlled, good tracking must be available. After the first 4-6 orbits, the ground tracking coverage becomes spotty until about one day after launch. Thus the opportunities for phasing maneuvers are quantized by the

ground tracking availability. Also, provision must be made for the scheduling of the crew eat-sleep-eat cycle in between the maneuvers. MSC accepted an action item to establish limits and constraints on the time to rendezvous the CM/SM with the Orbital Workshop.

The situation is much different for the unmanned launch of the AAP-4 LM/ATM. The LM must be launched in phase because the LM systems do not have the capacity for phasing beyond that required for a fourth-orbit rendezvous. Thus the LM launch time must be carefully selected; the AAP-3 CM/SM will have to be launched 3-5 days earlier than the LM. If the LM does not get off at the selected time, a delay of several days will probably result, depending on the yaw-steering capability of the AAP-4 S-IVB. MSFC will establish yaw-steering limits for the AAP launches to 35° orbits.

Next MSFC presented the WACS impulse budget. This data had previously been given at the September 26 Weight and Performance Review and also at the October 17 WACS PRR Working Group Meeting. One item of note which surfaced is that a 2% gaging error is assumed for WACS. This is possible because of the metal-bellows propellant expulsion system which allows easy and accurate determination of propellant volume. This was of particular interest to the MSC representatives since they must contend with the relatively inaccurate PVT gaging system on the RCS and also on the SPS during orbit coasting.

Finally, the question of design trajectories was taken up. MSFC agreed to work out a schedule whereby they will produce design trajectories for the CM/SM flights. MSC must first supply to MSFC the guidance equations for the 2-1/2 stages program. MSFC will run three-stage simulations to an MSC-provided insertion vector to determine the S-IVB cutoff vector. MSC will then use the S-IVB cutoff vector as the initial point of a detailed CM/SM orbit insertion trajectory.


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